White Paper

A review of offloading devices for heel pressure injuries

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The burden of pressure Injuries

Pressure injuries are a common healthcare problem that not only burdens patients but the overall healthcare economy. Pressure injuries/ulcers are localised damage to the skin and/or underlying tissue, usually over a bony prominences or related to a medical devices, resulting from prolonged pressure or a combination of pressure, friction & shear (NPUAP 2025). In Australia, the total cost of managing pressure injuries in public hospitals was $9.11 billion in 2020 (1,23). This figure includes direct costs such as treatment expenses as well as indirect costs such as lost productivity and reduced quality of life for the patient.

Among the outgoing expenditure are the management of heel pressure injuries. The heels are the second most common anatomical location for pressure injuries, followed by the sacrum. Several risk factors for pressure injuries include immobility, poor circulation, and conditions that affect sensation or skin integrity such as diabetes and older age. Other contributors are inadequate nutrition and hydration, incontinence causing moisture on the skin, obesity, and smoking.

Anatomy of the heel

Due to the anatomical structure of the heel, it is highly vulnerable to a pressure injury. The heel has a large fatty pad to the plantar aspect designed to withstand impact and pressure from the calcaneum (heel bone) when walking or standing by distributing the body weight and thus "load" through the plantar surface of the foot. However, when a person is supine, pressure is transmitted through the posterior heel, which has minimal padding between the skin and calcaneal bone (8).

At risk groups

With age related comorbidities such as cardiovascular disease and diabetes, the lower limbs are prone to peripheral vascular disease, oedema and neuropathy subsequently increasing the risk of pressure injuries on the heels due to skin frailty, decreased perfusion and impaired sensation. Globally, the ICU-acquired prevalence of heel pressure injuries vary from 19% to 35% while the prevalence of post-operative heel ulcers can vary from 13.8% to over 50% (17,20,5,27,11,6) Contributing factors includes (but not limited to) the level of immobility, length of hospital stay, severity of illness, nutritional status, peri operative patient positioning & comorbidities. Evidence show that epidural analgesia and peripheral nerve blocks for elective procedures increases the risk of developing heel pressure ulcers (13, 21), predisposing post-operative individuals at an increased risk.

Clinical evidence

Pressure injuries (PI) have been largely viewed as an avoidable harm to patients. The National Pressure Injury Advisory Panel (NPIAP), the European Pressure Ulcer Advisory Panel (EPUAP) and the Pan Pacific Pressure Injury Alliance (PPPIA) have developed international guidelines in the prevention and management of (PI). The 2025 guidelines detail a comprehensive and multidisciplinary approach in the prevention and management with its key practice statements mentioning early identification and risk stratification, patient repositioning and education, nutritional screening and regular skin checks (29). The 2025 guidelines are structured to be a live document so that guidance and good practice statements are continuously updated and in line with current and evolving evidence base practice. Heel specific devices related to pressure care can be categorised into two:

1. Continuous low-pressure devices which aim to distribute pressure over a larger surface area (gel or foam gel cup or bootie)
2. Offloading devices that prevent contact between the heel and the bed (suspension boots, wedges).

The use of pressure offloading devices is outlined in the 2025 International guidelines. Studies found the benefit of offloading the heels resulting in "floating heels" are widely regarded with numerous studies supporting its clinical benefits in the reduction in incidences and facilitating wound healing (15,7,9,22). However, there is a lack of unbiased high-quality evidence comparing the types of offloading devices to help narrow down the selection process. In addition to pressure care and positioning management of the lower limbs, the guideline recommends positioning the knee at a 5-10 degrees of flexion to reduce the risk of popliteal vein compression and subsequently reduce the risk of deep vein thrombosis (DVT). This implies the practical importance of correctly positioning foam wedges that suspend the heel. Another consideration is the undue pressure placed to the achilles tendon using blocks that can also lead to a skin breakdown due to minimal soft tissue padding & lack of blood supply to the skin over the achilles tendon (16) (Figure 1). It is important that as part of a comprehensive care plan, reducing & redistributing the pressure around the achilles tendon and calf muscle is considered especially to those with significant immobility,

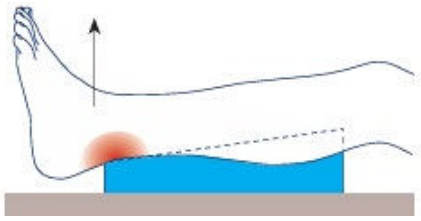

Figure 1

loss of sensation or reduced level of alertness or consciousness. To prevent device-related PI's, correct fitting and positioning of the device according to the manufacturers instructions is essential in product efficacy.

Heel offloading devices

Heel offloading devices can vary in design such as air based, foam based or cushion based (figure 2). With the wide availability of heel offloading devices and lack of high-quality control trials, the expert consensus on selecting the "correct" heel offload device are based on cost, clinical justification and implementing key strategies such as pressure reduction and minimising shear and friction. Desirable characteristics of a heel protector include the ability to elevate the heel off a support surface, decrease friction & shear, reduce and redistributing pressure away from the achilles tendon and lastly provide structural support to reduce those at higher risk of developing plantar flexor contractures which can dramatically impact a patient's ability to stand and walk.

A systematic review and meta-analysis found that offloading devices can reduce the risk of heel ulcers (Stage 1 and 2) when compared to standard care. This study mainly compared air based and foam based suspension boots against standard care which included support surface, repositioning, skin checks and hospital pillows for heel suspension. The author highlights the low to moderate quality of trials due to detection bias and study methodology (15). Comparatively, an Australian multi-centre, single-blinded randomize control trial of 394 critically ill patients in ICU found that the use

of a heel-offloading boot statistically significantly reduced PI development when compared to heel offloading using pillows(4).

Figure 2. Examples of heel offloading devices

Foam and cushion heel protector are shown to provide pressure relieving and redistribution benefits (3, 28) but when comparing foam surfaces versus air filled surfaces, a study suggests that foam may increase the risk of developing pressure ulcers, outlining the potential superior benefits to air-based support surfaces (24). Additionally, when comparing (reactive) air versus foam and gel surfaces, reactive meaning non powered air surfaces, a meta-analysis concluded that air surfaces are more favourable compared to foam in reducing pressure ulcer risk and may facilitate healing (24). In contrast, a study compared cushion, foam and an air heel protector and found that there were no statistical differences between the devices regarding pressure ulcer development however outlined a bigger sample size would be required to produce statistical significance (14). It's important to note that the authors highlight the need for higher quality trials that are unbiased with a generous sample size. Test methodologies also vary in clinical trials meaning it is difficult to compare "apples to apples".

Microclimate

There is limited evidence examining skin microclimate on air based, foam or fabric based heel boots. Typically when comparing air and foam cushions and mattresses, air based designs show superiority in temperature regulation compared to foam, which may have a positive impact on wound healing and or reducing skin breakdown. Another material used in the current market is polyurethane known for its unique stretch, thermal and vapor-permeable properties. However, a study analysing heel skin temperature found that polyurethane film dressings are not as effective as multilayer polyurethane foam with silicone dressings (11). No definitive conclusions can be stated due to a lack of quality trials assessing heel support surfaces and skin temperature. Although the relationship between support surfaces and microclimate are not scientifically robust, there is some evidence that suggest microclimate can be an indirect risk factor of the development of pressure injuries (19).

Compliance

Compliance with offloading devices are frequently highlighted in the literature (15,7). Patient comfort is a significant barrier to conformance as most heel boots are bulky and often deemed as "hot & bothersome" and may restrict free movement in bed (2,9,14,28).

While conformance is one particular barrier, spontaneous leg movement and users that may be agitated result in pillows or wedges being displaced or heel protector boots improperly positioned, rendering it's primary purpose futile. Perceived increased risk of falls with suspension boots is also outlined by Clegg & Palfreyman (7).
Based on the above findings, desirable characteristics of offloading devices include a light-weight low friction design, adequate vapour permeability, low maintenance and structural features that does not hinder self repositioning movements which ultimately may improve user compliance (figure 3).

Figure 3. Example of light weight suspension boots

Pillows

Standard of care for pressure injury prevention may also include utilising pillows. The 2025 guidelines mentions using standard pillows or cushions with sufficient height, if a heel offloading device is not available or inappropriate for the individuals activity and mobility level. One study found using standard pillows as effective as an air based boot where air can be pumped, however due to the small sample size and methodology the results are interpreted cautiously (26). Total heel suspension using a pillow may be difficult to maintain due to a hammocking effect which in turn increases the contact area at the heel and may increase the risk of foot drop (26).
The gross evidence suggests that offloading devices have greater favorable outcomes than using pillows despite it's lower cost (26, 14,4). It has also been suggested to refrain from adding additional pillows under the knee when an offloading device is present as this can cause increased knee flexion resulting in the heel being in direct contact with the support surface, rendering the heel boot futile.

Conclusion

Given the paucity of high-quality evidence and the heterogenous nature, clinical decisions regarding the selection of heel specific devices to ensure "floating" heels rely on a combination of existing available evidence and clinical expertise subject to the wide variety of patient groups. The main factors are cost and compliance where each healthcare setting will have various budgets, local policies, standards of practice and their available resources. Despite the limited availability of high quality comparison studies and control trials, there is robust evidence to support devices that offload the heel for the prevention of heel pressure injuries and to assist in the aid of healing them (NPIAP, EPUAP, PPPIA, 2025).

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